BOTANICAL GAZETTE.

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Asa Gray.

BY CHARLES R. BARNES.

(WITH PLATE A.)

It is neither suitable nor necessary that the GAZETTE should eulogize him. All the world knows that he is the most eminent American botanist, all botanists know why he is thus *facile princeps*, and all who have enjoyed personal intercourse with him know how unassumingly he bears his well-merited honors, and how gentle and genial is his whole life and character. Assuming that the incidents in the life of a great man are of interest to his disciples and co-workers, the GAZETTE accompanies the portrait of the man with this brief sketch of his life.

Asa Gray was born in Sauquoit, Paris township, Oneida Co., N. Y., on the 18th of November, 1810. His father had been apprenticed to a tanner and currier and must have been still working at the trade when this eldest child was born, for the little house which was his home stood on the tannery premises, and had formerly been used as a shoe shop. When the boy was a few years old his parents removed to Paris Furnace—a small settlement about a smelting furnace which long ago disappeared—where his father established a tannery. Here the monotonous occupation of feeding the bark-mill and driving the old horse that turned it was assigned to the child.

His schooling began at the age of *three* years, and at six or seven he was a champion speller in the numerous "matches" that enlivened the district school. Later, he attended, for a year or two, a "select" school taught at Sauquoit by the village pastor's son, and at twelve or thereabouts he was sent to the Clinton Grammar School. Here he stayed two years. His summer vacations were spent in the hay or corn-fields, for his father had begun to buy up the land cleared by the Furnace Co. for charcoal, and to turn his attention to farming. After leaving the Clinton school he went, in October, 1825, to the academy at Fairfield, Herkimer Co., seven miles north of Little Falls, where he re-

mained a year. His father, who thought an investment in land better than one in a collegiate education for his son, persuaded him to begin at once the study of medicine. He therefore entered the "Medical College of the Western District" (located at Fairfield) in the autumn of 1826, whose courses of lectures in chemistry he had attended the year before while at the academy. The annual sessions were very short.

In the spring and summer of 1827 he studied with Dr. Priest, of Sauquoit, returning to the medical school in autumn. In that winter, 1827–8, he chanced to read the article *Botany* in Brewster's Edinburgh Encyclopædia. He was greatly interested, bought Eaton's Manual and read its pages eagerly, longing for spring. He sallied forth early, discovered a plant in bloom, brought it home and found its name in the Manual to be *Claytonia Virginica*, the species *Caroliniana* to which the plant really belonged, not being distinguished then. In the same spring he became a pupil of Dr. John F. Trowbridge, of Bridgewater, with whom he stayed three years, except during the annual sessions of the medical college. In the frequent rides about the country to visit patients he had abundant facilities for observing and collecting plants, and, besides studying out their names, he began a herbarium. In the autumn, when he returned to the medical school, he took with him a bundle of specimens which had puzzled him, hoping to get assistance from Professor Hadley. He studied Prof. Hadley's small herbarium during the winter, and by his advice opened correspondence with Dr. Lewis C. Beck, of Albany.

These botanical studies continued to occupy his leisure. In the summer of 1829 he collected largely, and in the summer of 1830 went to New York to buy medical books for Dr. Trowbridge. He took with him a package of undetermined plants and a letter of introduction to Dr. Torrey, but was disappointed by not seeing him. He left the plants, however, and in the winter received a letter from Dr. Torrey naming them, the first letter of a correspondence which lasted until Dr. Torrey's death, in 1873. Young Gray's medical course was closing. He had attended four annual courses of lectures, besides the work with his preceptors, had passed the examinations, and in the spring of 1831, six or seven months before he passed his 21st birthday, he received the degree of M. D.

In the latter part of May and June he delivered his first course of lectures on botany, Dr. Beck, who had been lecturing previously, having given up the engagement. With the money

thus earned, he made a collecting tour through western New York, going as far as Buffalo and Niagara Falls. About this time he received an appointment as teacher of chemistry, botany, geology and mineralogy in a private school for boys in Utica, controlled by a Mr. Bartlett. His first summer vacation was spent in a trip through southern New York, Pennsylvania and New Jersey, collecting plants, fossils and minerals. At Bethlehem he spent a day with Bishop Schweinitz. Arriving in New York City, in September, he met Dr. Torrey for the first time, and went with him on a collecting trip to Tom's River, N. J.

During the next summer he was employed by Dr. Torrey to collect in the "pine barrens" of New Jersey, and the regions about Little Egg Harbor, Wading River and Quaker Bridge were scoured by him. On one of his excursions he fell in with an entomologist who proved to be Major Le Conte. Many of the plants which he collected in this locality came into possession o B. D. Greene, and are to be met with in various herbariâ labeled "Coll. Greene." The winter was spent at the Bartlett school, but the spring saw him on another collecting tour along the Black river. During the summer he gave a course of lectures on mineralogy and botany at Hamilton College, Clinton, N. Y., for Professor Hadley.

In the autumn he got a furlough from the Bartlett school in order that he might be Dr. Torrey's assistant in chemistry in the medical school at New York. During this winter, 1834–5 (?), he lived with Dr. Torrey, and worked all the spare time in his herbarium. At this time he issued the first century of "Gramineæ and Cyperaceæ of North America." In December, 1834, he read his first paper before the New York Lyceum of Natural History, entitled: "A Monograph of N. Am. Rhynchosporæ," and a second one, "A notice of some new, rare or otherwise interesting plants from the northern and western portions of the State of N. Y." In February or March he returned to his school work at Utica, but the summer again found him collecting plants and minerals in northeastern New York. An account of the minerals then collected forms his first contribution to the American Journal of Science.

He expected to return to New York in the fall, as Dr. Torrey's assistant, and to this end had resigned his position in the Bartlett school. But the autumn brought a letter from Dr. Torrey saying that the prospects of the school were so poor that he could not afford to employ him. Nevertheless he went to New York, assisted Torrey as he had opportunity, and issued the second century of "Gramineæ."

In the summer of 1835 he returned to his father's home with some books received from Dr. Lehmann, of Hamburg, in exchange for plants. In this summer he planned and partly wrote his "Elements of Botany," and when he returned to New York in the autumn, arranged for its publication. It appeared in May, 1836. In the fall of this year he was appointed curator of the collections of the New York Lyceum of Natural History, and in its new building he made his home. There he wrote two papers: "Remarks on the structure and affinities of the Ceratophyllaceæ" and "Melanthaceæ rum Am. Sept. Revisio," both of which were published in 1837. As the duties of his curatorship were light, and he had time on his hands, Gray took hold of the work of making a preliminary revision of some of the orders for the Flora of North America, which had been planned by Torrey. He was at this time awaiting the sailing of the exploring expedition to the South Pacific, to which he had been appointed botanist in the summer of 1836. The departure was long delayed. When the "Wilkes Expedition" finally sailed it was with a smaller fleet and a reduced staff. In the meantime (1838) Dr. Gray was elected professor of Natural History in the just-organized University of Michigan, and when the staff of the Wilkes expedition was to be diminished he resigned in favor of the assistant botanist, Wm. Rich.

As in the year or more in which he had been working at it, Dr. Gray had accomplished so much work, Dr. Torrey invited him to become joint author of the Flora of North America. In July, 1838, the first part, and in October, 1838, the second part of this work was issued. Having gotten so far, it was necessary to consult the American collections in European herbaria. Dr. Gray therefore asked a year's leave of absence from the University of Michigan, that he might go to Europe. This was granted, and a considerable sum of money was placed in his hands by the trustees to be expended in purchasing books for the infant University.

He sailed in November, 1838, and went at once to Glasgow, where he was the guest of Dr. W. J. Hooker. In England he consulted various public and private herbaria, and met Arnott, Greville, Graham, Balfour, Boott, Bentham, Robert Brown, Bennett, Lambert, Lindley, Bauer, Ward, Menzies and others. In March, 1839, he crossed to the continent and made an extensive tour of the principal points of interest, keeping in mind always the chief object of his visit. In Paris he met Mirbel, Adrien Jussieu, Brongniart, Decaisne, Spach, A. Richard, Montague,

Gaudichaud, Delessert, Jacques Gay and Boissier; at Lyons, Seringe; at Montpelier, Delile and Dunal; at Vienna, Endlicher and Fenzl; at Munich, Martius and Zuccarini; at Geneva, the De Candolles and Reuter; at Halle, Schlechtendal; at Berlin, Klotzsch, Kunth, Link and Ehrenberg; and at Hamburg, his early correspondent, Lehmann. His letters to Dr. Torrey, which contain a complete account of his journey and doings, are still in existence.

When he returned, late in 1839, he found matters at Michigan University still in a somewhat chaotic condition, and the trustees were willing to extend his furlough. Accordingly he began earnest work on the Flora, and parts 3 and 4 were issued in June, 1840, and in the following spring the first 184 pages of vol. ii appeared.[1] In the summer of 1841 he collected in the valley of Virginia, going as far south as Grandfather and Roan Mts. in North Carolina. In January, 1842, he made his first visit to Boston, as the guest of B. D. Greene. While there he made the acquaintance of President Quincy of Harvard College, and in April the Fisher Professorship of Natural History was tendered him. This he accepted, and went to Cambridge in July. This position he holds to the present time.

At Cambridge he devoted his time to the reorganization of the botanic garden and the necessary instruction of students, giving whatever time he could command to continued study of the voluminous and important collections which poured in from all sides, especially from the government surveys of new territory and the assiduous work of individual collectors. The results of this study, of the highest importance, are embodied in various memoirs in different publications. This embarrassment of riches caused the suspension of the Flora of North America.

About the time he went to Cambridge appeared the first edition of the Botanical Text-book, of which the second volume of the *sixth* edition has just been issued. In 1848 he began the publication of the "Genera Illustrata", of which the second volume was published in 1849. In 1848 the first edition of the "Manual" appeared. When the Wilkes Expedition returned, all its material was put into his hands. The report on these collections forms a large quarto volume with an atlas of one hundred royal folio plates. It is not possible, however, to enumerate even the most important of his writings since 1842. They are scattered through the American Journal of Science (of which he

[1] Pages 185–400 were issued in the spring of 1842, and the remainder of vol. ii in February, 1843.

became associate editor in 1853), the Annals of the N. Y. Lyceum of Natural History, the Memoirs and Proceedings of the American Academy, Hooker's Journal of Botany, the Journal of the Linnæan Society, the Smithsonian Contributions to Knowledge, the North American Review, the Bulletin of the Torrey Botanical Club, the American Naturalist, and the BOTANICAL GAZETTE.

Every one is familiar with the text-books, passing through many editions, which have made his name a household word, and which fully demonstrate that scientific truths can be popularized without being distorted or transformed into errors. Many learned societies of this country and Europe have honored themselves and him by electing him to membership and to offices of honor. For over *fifty years* he has been a member of the oldest natural history society in Europe, Academia Cæs. Leopoldino-Carolinæ Naturæ Curiosorum, from which he received, on the fiftieth anniversary of his election, a letter of congratulation.

In 1864, his offer to Harvard University of the immense and priceless herbarium which he had accumulated, on condition that a fire-proof building be erected to contain it, was accepted and the herbarium building put up. The special library attached to the herbarium, consisting of nearly 5,000 volumes, and over 3,000 pamphlets, is very largely due to his generosity.

Since 1873, at which time he retired from the work of instruction, he has devoted himself assiduously to the preparation of the Synoptical Flora of North America, a work which will represent, when complete, the greater part of the labor of a lifetime. No more earnest wish can be uttered by the American botanists whom he has served so long than that his unabated vigor may continue until he has finished this masterpiece of scholarly learning and critical acumen.

Birthday Congratulations.

UNIVERSITY OF MICHIGAN,
SECRETARY'S OFFICE, ANN ARBOR, November 16, 1885.

Professor Asa Gray, M. D., LL. D., Cambridge, Mass.:

MY DEAR SIR:

The Senate of the University of Michigan wish, as a body, to be represented among the many friends who will join in paying their respects to you on your approaching seventy-fifth birthday, and to that end has adopted a congratulatory address, of

which I have the honor, as Secretary of the University Senate, herewith to transmit to you a copy.

At the same time, allow me to recall the privilege I had, more than a quarter of a century ago, of sitting under your instruction, and personally to extend to you my most cordial greetings and congratulations. Very respectfully yours,

W. H. PETTEE.

[Congratulatory Address, adopted by the Senate of the University of Michigan, November 9, 1885.]

To Professor Asa Gray, M. D., LL. D.:

The Senate of the University of Michigan, mindful of the approach of the seventy-fifth anniversary of your birth, take great pleasure in sending you their greetings on the occasion. We congratulate you that life and health and usefulness have been prolonged till three-quarters of a century have passed over your head. We entertain the hope that many years of activity yet remain.

With our congratulations we beg to give expression to a lively sentiment of gratitude for services rendered to your chosen science during a long and devoted life. You found the science of botany barred by a hedge of technicalities against the approach of the common student. You have made it the delight and inspiration of the youth of the land. You have subjected the science of botany in its *higher* departments to lucid and masterly exposition. Many of the comprehensive and critical reviews of the American flora have proceeded from your pen. The botanical pages of the *American Journal of Science* reveal labors sufficient in volume and value to fill and honor a lifetime. And those labors are yours. We hail you as the Nestor of American botany. Few of us there are who do not feel gratefully proud to testify our personal obligations to you for aid and inspiration in our earlier studies; and none of us fail to appreciate the services and honor which you have rendered to education and cultivated scholarship. We recall the catholic spirit and breadth of view with which you have treated questions of the interpretation and philosophy of science. We thank you for your acute but just and conservative criticisms and estimates of the doctrine of evolution through natural selection, at a time when the doctrine was new and rising into overshadowing importance which filled many honest minds with apprehension. We thank you again for stepping to the defense of fundamental religious truth through the power of the very philosophy which so many thought sent into the world

to destroy religion. But for all that you have done we do not release you from service. We expect you to serve yet many years the cause of education and sacred truth; and we expect to concede you the highest honors of all for the labors which, we trust, are to adorn the last quarter of your century.

With us the pleasure of these congratulations is quite peculiar, since we can hail you as an ex-professor in our University. Your memory readily reverts to the crude infancy of this institution, when your name was chosen to stand first in its list of professors. You recall your actual participation in the labors of our early organizers; and we trust that while your recognized gifts of mind and heart found early employment in a broader field than was offered in Michigan, you have never ceased to entertain an interest in the University which you aided to inaugurate, and have some personal satisfaction in seeing the slender shoot of 1838 grown to the dimensions of the sturdy oak of 1885.

Accept, Respected Sir,

Our Kind Remembrance

And Our Cordial Greeting.

DR. GRAY'S REPLY.

CAMBRIDGE, MASS., November 20, 1885.

Prof. W. H. Pettee, Secretary of the Senate of the University of Michigan:

DEAR SIR:

I can not well say how deeply I was touched and gratified by the Congratulatory Address from the Senate of your University, which I found on my table on the morning of my seventy-fifth birthday, accompanied by your official and friendly note. I was particularly impressed with the breadth of its survey of the labors of my life, and with the discriminating reference to some of them which would escape ordinary notice. I beg you to convey to the Senate my grateful acknowledgement of the very kind notice thus taken of my endeavors. I recognize, moreover, the fitness of its intimation that I should make the most of the few years that may perhaps remain. I am happy to be able to declare that my appetite for work is as yet unabated; also that labor is still attended with joy rather than with the *sorrow* which the Psalmist contemplates.

I am much pleased that, although a deserter from the ranks before the war began, I am generously recognized as an ex-professor of the University of Michigan. I suppose that the only direct service I ever rendered it was that of getting together, when in Europe in 1838–9, the books which were the small

foundation of its library. I well remember the gratified feeling with which, long afterwards, I incidentally heard that the first President of the University, on viewing this slender collection, expressed the opinion that the books had been well selected for the purpose.

I have never ceased to be particularly interested in the University in which I expected to pass my life. I regret that circumstances have hitherto almost wholly prevented me from personally verifying the impressions which I have received of the amplitude of its appliances for the higher education and of the worthy and efficient use that is made of them. I am, indeed, glad that I have lived to see the acorn which was planted in my youth develop into "the long-surviving oak," vigorous and beneficent in its youth, and rich in the promise of future years. May its leaf never wither nor its fruitage fail.

Please convey to the Senate my heartiest thanks for such "kind remembrance and cordial greetings," and believe me to be

Very truly yours, ASA GRAY.

LINES

On Dr. Asa Gray's Seventy-fifth Birthday, November 18, 1885.

Oft times it haps the singer's voice is dumb
When most is needed eloquence of song;
And oft the heart, though stirred by passions strong,
Can make no sign, nor will fit language come
The depth of its affection to make known:
So is it with myself. I fain would pay
Some tribute worthy one whose wealth is shown
In kindnesses to others—ASA GRAY!
But my full heart refuses to express
Its affluence of love. I can but raise
A feeble voice and wish him happiness
On this birthday, when friends have come to praise
His virtues and his works. To such as he
There cometh certain immortality!

GEORGE E. DAVENPORT.

TO A. G.

On his Seventy-fifth Birthday.

Just Fate, prolong his life well-spent
Whose indefatigable hours
Have been as gaily innocent
And fragrant as his flowers!

November 18, 1885. JAMES RUSSELL LOWELL.

TO DR. ASA GRAY.

November 18th, 1810–1885.

Over the earth is reachless, living light
In flaming marvels that defy the sight;
  Under the earth are brilliant things, but dead;
  Who toil among them are disquieted.
    The world of green
    That moves between—
With sweets and colors, flowering turf and height—
  Comes close with health and beauty as with bread,
  Touches us fondly, foot and hand and head,
  Till we are glad and healed as well as fed.
The child, the feeble, and the lusty man,
Each finds a mother in the green earth's plan.

Thou who art wise with searching all her looks,
And givest ages wisdom through thy books;
  The secrets of her breath are in thy hold—
  In years and science only art thou old.
    The flowers' faces
    Have sent such graces
Into thine own, as bless their native nooks.
  Ferns, grasses, ancient trees of mighty mould
  Whose mazy roots run deep, whose aim is bold,
  Their varied forces in thy life have told;
For, while intent on flower or tree or sod,
Thy soul's full eye hath been upturned to God.

CHARLOTTE FISKE BATES.

The Pollen-spore of Tradescantia Virginica L.

BY JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE I.)

The pollen-spores of Tradescantia Virginica are exceptionally favorable for study. With the simplest appliances, and with few staining reagents, both nuclei can be demonstrated, the development of the pollen-tube can be watched, and the descent of the nuclei plainly followed. We have not been able to consult Hartig's paper,[1] in which is recorded the original discovery of two nuclei in pollen-spores, among which he includes those of Tradescantia, but the general facts pertaining to the subject are well presented in the works of Strasburger and Sachs, and recently summarized in this country by Goodale. In fact, to Strasburger is due most of our knowledge of this interesting subject, his latest views being presented in the first part of his *Neue Un-*

[1] Karsten's Botan. Untersuch. iii. 1866.

tersuchungen,[2] published in 1884. The only original paper upon the subject published in this country is that of Barnes on Campanula Americana.[3]

All these authors agree in their testimony as to the difficulty of performing this work, and so the demonstration of these recondite, but very important, facts has been left entirely to trained investigators. Knowing that the pollen-spores of monocotyledons were much more favorable for study than those of dicotyledons, which are certainly too difficult for ordinary observers, and desiring to discover some plant in which these almost inaccessible facts could be seen with comparative ease, the pollen-spores of Tradescantia were selected. The result was so signally successful, and the methods were so repeatedly tested, that we present them in this paper.

The simplest kind of moist chamber was prepared, such as is described by Bower and Vines,[4] and Goodale.[5] Two pieces of heavy blotting paper were cut the size of a glass slide, and a hole cut through the middle of them just large enough to allow a cover-slip to rest upon the edge all around. The slips of blotting paper were then saturated with water and placed upon a glass slide. A saturated solution of cane sugar was prepared, and a drop placed upon a cover-slip upon which pollen-spores had been sown. The cover-slip was then inverted, and placed over the hole cut in the blotters, and the pollen-spores were thus ready to germinate in a hanging drop of sugar solution, in a chamber in which evaporation was impossible. The blotters being kept moistened, the culture was continued as long as desirable. It is always preferable to place the pollen-spores upon the cover-slip before the drop of sugar solution, as otherwise they are apt either to remain out of reach of the objective, or to send their tubes directly towards it, thus giving end views instead of profiles. The best results were obtained with pollen-spores from flowers that had been open for some time, such seeming to respond more readily. A power of 250 diameters was constantly used in the work, though the figures of the plate are drawn larger (460 diameters) for the purpose of securing clearness of detail. The spores are elliptical in optical section, and the extine is so thin and so free from the customary markings of pollen-spores that the details of the interior can be easily seen. In a few min-

[2] For review see Bot. Gazette, x. 328.
[3] Bot. Gazette, x. 349.
[4] Practical Botany, p. 16.
[5] Physiological Botany, p. 430.

utes, at most five or ten, the spores swelled up sufficiently to show their contents, and usually the two nuclei became plainly visible. Figures 1–4 show some of their most common positions. In the nomenclature of these nuclei we use that of Strasburger in his *Neue Untersuchungen*, followed by Barnes in the paper already referred to, and exactly the opposite of that of Strasburger in his *Botanisches Practicum*, and Sachs in his Text-book.[6] The generative nucleus is a thick, worm-like filament, tapering at both ends, and always more or less coiled. Its appearance is exactly that figured by Bernimoulin in his studies[7] in the division of the nucleus in the pollen-spore mother-cells of the same species. The vegetative nucleus is round or oval, of much smaller size, and some of its positions with reference to the generative nucleus are shown in figures 1–4. In some cases, as in figure 4, the generative nucleus is seen almost to encircle the contents of the pollen-spore. In figures 5 and 6 is seen the small cell cut off from the larger one, containing the generative nucleus, and forming the generative cell. The generative nucleus always lies against the intine wall, and its apparent central position in some cases, as in figures 1 and 3, is explained by the fact that it is lying against the upper or lower wall in the figure. The wall which cuts off the generative cell seems to be simply an ectoplasmic layer of protoplasm,[8] and not in any case cellulose. That this layer is often difficult to demonstrate seems to be due both to the fact that the generative nucleus almost entirely fills its cell, and that it is so transparent that only an exceptional position will bring it into view.

Usually within fifteen minutes, or at most half an hour, the pollen-tube can be seen developing from the larger or vegetative cell. It breaks through the extine at one end of the spore, and the broken edges of the extine can be seen turning back from the emerging tube, figure 7. The generative nucleus retains its position until the pollen-tube is of considerable length, when it can be seen shifting its position towards the side of the pollen-spore from which the tube is developing (figure 8). The streaming movement of the protoplasm, which carries the nuclei into the tube, was not demonstrated other than by the changes of position in the nuclei themselves. The fact that the nucleus of the vegetative (large) cell invariably remains towards the further end of the spore until the generative nucleus passes into the tube, seems

[6] Second English edit., p. 554.

[7] Note sur la Division des Noyaux dans le Tradescantia Virginica. Bull. Soc. Roy. bot. Belgique, t. xxiii.

[8] Sachs' Text-book, 2d English ed., p. 583.

to be contrary to the usual order.[9] In entering the tube the curved generative nucleus usually straightens, or may remain curved at the posterior end. Its course, as seen, can be traced in figures 9, 10, 11, etc., the coiled posterior end being brought into view in figure 13. Owing to the size of the generative nucleus it was hoped that its division could be demonstrated, but such was not the case. Although in some instances it was suspected, it was not clear enough to be certain.

After the generative nucleus had entered the tube, the nucleus of the vegetative cell seemed to be carried forwards, and when the former had proceeded some distance down the tube, the latter was swept into it, and followed along at considerable interval (figures 10, 11, 12, 13). The vegetative nucleus retained its structure perfectly as far as we were able to trace it in the cultures.

The nuclei in the spores could always be demonstrated after a short immersion in the sugar solution, without the use of a staining fluid, but of course were brought out much more distinctly by it. The nuclei in the pollen-tubes, however, were never seen, with certainty, without staining. The method employed was as follows: A drop each of magenta solution and ordinary acetic acid was placed upon a slide, the cover-slip with hanging drop of sugar solution containing the developing pollen-tubes was let down into it, and then, after a moment or two, glycerine was run under.[10] In this way the nuclei in the tubes receive a dark stain, while the intine is left colorless. Of course there are other and better methods and stains, but our object was to use only such reagents as could be obtained at any drug store. Crushing a stained pollen-spore resulted as shown in figure 17, by which method the shape and structure of the nuclei can easily be studied. It should be said that in many cases both nuclei were not visible, as is represented in figures 14 and 15, although this fact should not be connected with the spores that are exceptional in other respects. In many instances a tube began to develop from each end of the pollen-spore, as shown in figure 15, but one was usually stronger than the other. Quite frequently a pollen-tube developed from one side instead of the end, as represented in figure 14. These two cases would seem to indicate more than one point of emergence, contrary to the general rule among monocotyledons.[11]

[9] Sachs, Text-book, 2d English ed., p. 583; also Strasburger, Neue Untersuchungen, p. 15.

[10] Or the magenta and acetic acid were added directly to the culture drop, allowed to stand a moment, and then inverted and mounted in a drop of glycerine.

[11] Sachs, Text-book, 2d English ed., p. 555.

In rare cases pairs of spores that had not completely separated were seen, but evidently mature, as in each one the two nuclei were demonstrable (figure 16). Sometimes, in strong and rapidly developing tubes which had attained considerable length, the intine of the pollen-spore seemed to be pulled away from the extine, or as though it had fallen in or was pushed in by external pressure which the more rigid extine resisted, as shown in figures 12 and 13, and finally became knotted up at the tube end of the spore.

In conclusion, then, the results intended to be presented in this paper are:

1. That in Tradescantia Virginica, by using the simplest appliances, and in a very brief time, the two nuclei of the pollen-spore, and their descent into the pollen-tube, can be demonstrated.

2. That in this species the generative nucleus is a large worm-like spindle, and precedes the vegetative nucleus into the pollen-tube.

A New Larval Entomophthora.

BY J. C. ARTHUR.

(WITH PLATE II.)

The clover-leaf weevil, *Phytonomus punctatus* Fabr., is a comparatively new insect in this country. It was first brought to public notice in 1881[1] as very destructive to clover in Yates county, N. Y. It has now extended considerably, being abundant at Buffalo, and in the adjacent part of Canada, and is also reported from Indiana. It is supposed to have been introduced from Europe, where it is common, but looked upon as innoxious.

In last of May and first of June of this year, the larvæ were found in a clover field at Geneva, N. Y., dying in vast numbers of some parasitic fungus. Again, in October and November, they appeared in the same manner over a large lawn. At the latter date as full a study of the fungus was made as limited time would permit. It proves to be an undescribed species of Entomophthora, and may be characterized as follows:

Entomophthora Phytonomi (n. sp.)—Mycelium abundant, branched, non-septate, colorless, 9–12μ in diameter, on the ventral surface of the insect growing out in form of rhizoids to act as holdfasts; hymenium over the whole surface except the head, 35–45μ deep; conidiophores branched at the base, as thick as the mycelium; spores oblong, colorless, 24–28μ long by 7–10μ thick. Resting spores not seen.

In the larvæ of *Phytonomus punctatus* Fabr. Geneva, N. Y., May—June and October—November, 1885.

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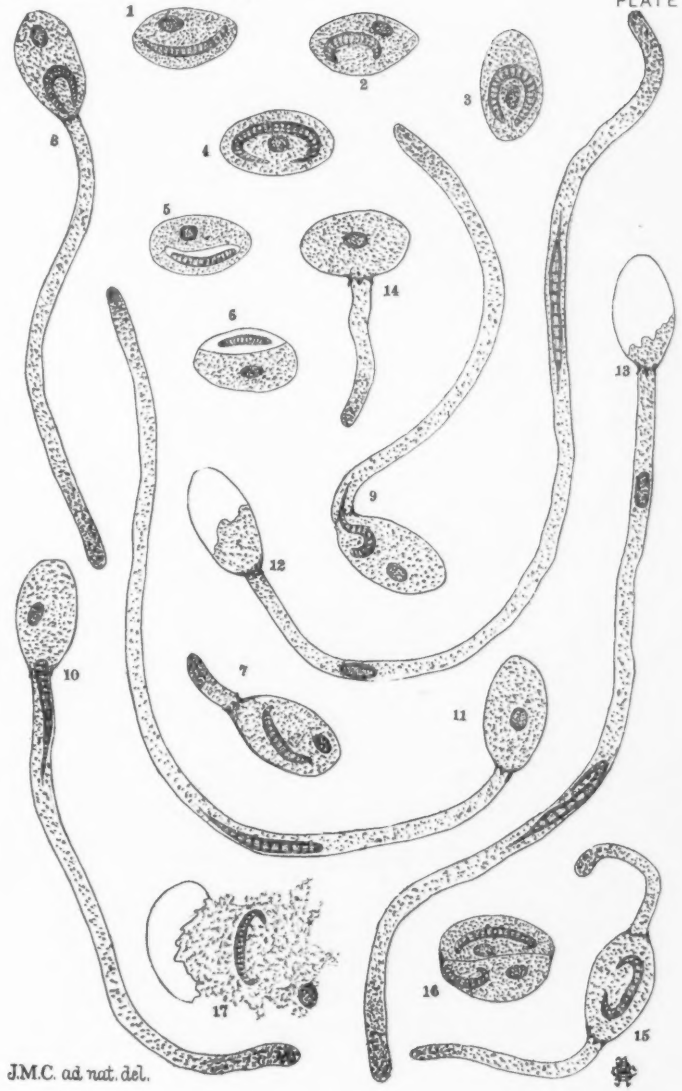
[1] Riley, Amer. Nat., xv, p. 751; Rep. U. S. Dep't Agric., 1881-2, p. 172; Lintner, First Ann. Rep. Insects of N. Y., p. 252.



COULTER & ROSE ON TRADESCANTIA.

The habit of the larvæ is to feed during the night and remain concealed during the daytime, but when attacked by the fungus they crawl as high as possible before daylight, coil around the edge of the object, usually horizontally (figure 1), and do not again descend. Until ten o'clock in the morning most of them are still able to crawl about when disturbed, but are sluggish. By noon the insect dies, and the rhizoids fasten it firmly to the support. Some hours afterwards the normal yellowish or pea-green color is changed to a dull gray by the appearance of the hymenium. The spores are produced late in the afternoon, and during the night they are discharged; by morning only a small shriveled and blackened mass remains, while the objects beneath are powdered with the colorless and evanescent spores. If the dead insect be placed on a pane of glass over night, the body will be surrounded in the morning by a halo of spores nearly two centimeters in diameter. When the atmosphere is damp enough during the night, the mycelium grows out over the whole body as a white pubescence. This is the usual course of development.

A larva dissected an hour or two before its death shows a mass of interlacing hyphæ (figure 9) among the muscles which line the outer wall of the body; the viscera are still unaffected. The hyphæ are quite uniform in size, with finely granular contents and vacuoles of various sizes, and are extensively branched. As the mycelium grows it encroaches upon the internal organs, and eventually fills up the whole cavity of the body, except that it does not enter the alimentary tract or the tracheæ. The internal organs, except the two just named, together with the fluids of the body are entirely consumed by the fungus. The larva when now cut across presents a firm interior traversed by the cavity of the alimentary tract (figure 5). In some cases, however, certain bacteria, and occasionally yeast, have become so abundant before this stage is reached that the tissues are converted into a slate-colored liquid, and the growth of the fungus is checked.

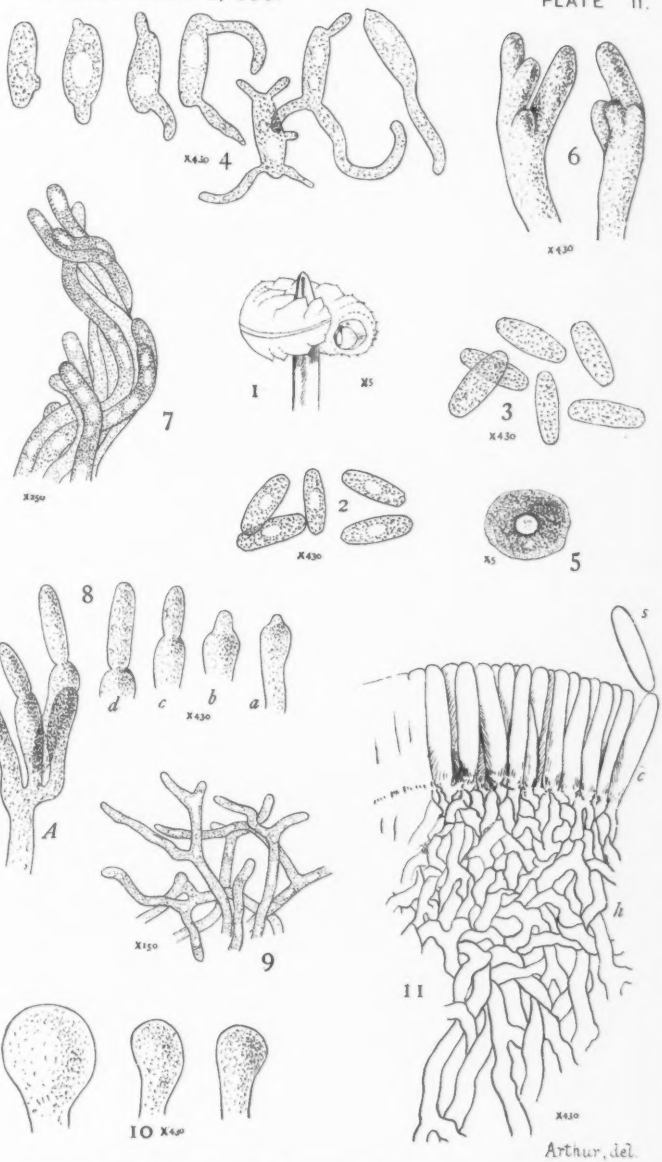
The rhizoids appear before the hymenium is formed, but whether before the insect is dead or not was not determined; nor was it ascertained on just what portions of the ventral surface they occur. They will extend a full millimeter in length when the insect is removed from the supporting object and placed in a damp atmosphere. They consist of straight colorless hyphæ, with walls much distorted and ends somewhat flattened.

The hymenium, which surrounds the whole body, presents a uniform thickness when not grown in a very moist atmosphere (figure 11). The conidiophores branch at their base (figures 6 and 8),

and each bears a spore, formed by abstriction (figure 8). I was unable to see, either in fresh or alcoholic preparations, any partition wall between the conidiophores and the hyphæ from which they arise, but do not feel entirely convinced in regard to the matter, as I found it difficult to separate them well, owing to the compact interlocking of the branches. Swollen hyphæ with granular contents (figure 10) were a few times seen among the conidiophores, but they could hardly have been paraphyses. No sterile hyphæ projected beyond the hymenium under ordinary circumstances. When the dead larvæ are placed in a damp atmosphere over night, the mycelium grows out a millimeter or so beyond the surface of the body in straight or somewhat coiled hyphæ (figure 7); these do not appear to be elongated conidiophores, or true paraphyses, but a luxuriant growth of the mycelium.

The spores are very regular and uniform in size (figure 3). When mature they are projected from the body of the larva, as in the common house-fly fungus, and like those adhere to whatever they touch. Spores gathered in May and kept dry till November measured, when examined in water, a little less than fresh ones, 21–27μ by 6–8μ, had one end slightly pointed, and exhibited a central non-granular spot (figure 2). Fresh spores are uniformly granular, and both ends are the same shape. They germinate in water in two to six hours by pushing out one to several tubes which grow irregularly and to indefinite length (figure 4). The protoplasm is filled with vacuoles, but does not all collect at the advancing ends of the hyphæ nor are there septa formed as in the closely related *E. sphærosperma* Fres. Their behavior when germinated in moist air was not observed. Spores kept upon glass in the laboratory gave but a small per cent. of germinations after five days.

This fungus is intimately related to *E. sphærosperma* Fres. (*E. radicans* Brefeld), the habit of growth being the same so far as investigated, but differs in ultimate shape of spores, septation of hyphæ, the various measurements, etc. Although observed as late as Nov. 20, when cold weather set in, no mummified larvæ containing resting spores were found. This could hardly have been because they were overlooked, for the sick larvæ are conspicuous by their position, and up to the date mentioned were dying by thousands. The disease appears to extend readily into an epidemic of economic importance; whether it could be propagated at will is yet to be determined by experiment.



ARTHUR ON ENTOMOPHTHORA, N. SP.

EXPLANATION OF PLATE II.—Structure and development of Entomophthora Phytonomi: Fig. 1, the position of larva of Phytonomus punctatus at tip of a blade of grass when sick with Entomophthora. × 5. Fig. 2, spores examined in water from a dry specimen gathered nearly six months before. × 430. Fig. 3, spores a few hours after maturity. × 430. Fig. 4, successive stages of germination of spores sown in water on a glass slide. × 430. Fig. 5, thin transverse section of larva showing the body cavity uniformly filled with mycelium, a peripheral border of hymenium and the alimentary tract at center empty except a little undigested food. × 5. Fig. 6, two hyphæ at an early stage in the development of the conidiophores. × 430. Fig. 7, a coil of hyphæ from the pubescence on larvæ in damp atmosphere. × 250. Fig. 8, *A*, hyphæ bearing four conidiophores, *a b c d*, successive stages in the formation of a spore. × 430. Fig. 9, mycelium from among the muscles at an early stage of the disease. × 150. Fig. 10, swollen ends of hyphæ, filled with granular protoplasm and without vacuoles. × 430. Fig. 11, hymenium *c*, and subjacent mycelium *h*; the spores have all been detached, *s* single mature spore; drawn from an alcohol specimen. × 430.

BRIEFER ARTICLES.

Anemone nudicaulis, n. sp.—I wish to direct the attention of any of our botanists, who may next summer be visiting Lake Superior, to a singular Anemone which grows in bogs and on banks near the water at Sand Bay, Minnesota, very near lat. 48°, and in or near the Canadian boundary. All I know of it is from a specimen sent to me in a letter, dated August 8, 1870, from Mr. Joseph C. Jones, then of the U. S. Steamer *Search*. He wrote that the plant was found growing in mossy ground, close to the water's edge, and also in the bogs, and that it grows in the manner of Coptis trifolia. I believe it has filiform root stocks, like those of Anemone Richardsoni, and the radical leaves are so like those of that species that I inadvertently mistook the plant for that species. But the involucre consists of a single petiolate leaf, very like the radical, or else is wholly wanting. And the akenes are tipped with rather short and hooked styles, very unlike the long ones of the aforesaid Arctic species. A flowering specimen is a desideratum.—ASA GRAY.

Dispersion of some tree seeds.—About twenty-five rods to the northwest of my foot-path on the lawn, there are two large white birch trees, still holding fruit of the last summer. Along the depressions of foot-steps and the mark of an occasional sleigh in the snow may be seen large numbers of birch seeds, looking as though some one had scattered bran on the snow. Most likely many other seeds went further, as there was fair sailing beyond.

For some years past I have often observed the distribution of the winged fruits of the tulip-tree, of which there are several on our lawns. In autumn part of the fruits drop off, falling near the tree, but even in the grass and weeds every wind tosses them a little further on. Before snow came this year there were certainly many of them ten rods from the nearest bearing tree. When the snow comes others are torn from the trees and may often be seen for a quarter of a mile going before the wind on the snow, which may be only very

slightly packed. I have known persons who stoutly maintained, from experiments made, that the wings of the fruit of the tulip-tree amounted to little, because they did not carry the fruit through the air like a miniature balloon.

The nuts of the basswood have also frequently been seen drifting on the snow before the wind, aided by the decurrent bract which is attached in such a way that the fruit cluster is not likely to remain flat on the snow or on the ground.

. Numerous other examples could be cited, but we shall leave the rest of them for some of the sharp students who are studying botany in winter.—W. J. BEAL, *Agricultural College, Mich.*

EDITORIAL.

WITH THIS INITIAL NUMBER of a new decade before us, it is impossible not to think of the change since a single naked sheet made its appearance a little more than ten years ago and announced its desire to become the organ of botanists. It was projected by one whose determination to make it succeed was unfailing, and so through troubles of all kinds the GAZETTE made its way. Desirable articles came in slowly, subscriptions still more slowly, and advertisements not at all, the constant financial loss being set over against a constantly increasing experience. At last botanists thought the struggle had been long enough to show vitality, and articles and subscriptions began to come in more rapidly, until the GAZETTE has entered upon its second decade with the hearty good will and substantial support of American botanists. The numerous letters of warm congratulation attest the fact of the very strong place the GAZETTE has made for itself, and it hardly needs to be said that its editors will spare no labor in trying to make it still more indispensable. In these days of numerous ephemeral periodicals it is both a strange and a creditable thing that the GAZETTE has survived, and it helps to emphasize the fact of the growing interest and vigor in botanical studies. The history of this journal can be taken as an index of botanical activity, and this country is to be congratulated that its botanists are so thoroughly aroused and energetic that the GAZETTE can enter upon its second decade with such enlarged space and aspirations. There can be no doubt but that the coming decade will witness unusual botanical activity in this country, many young men, strong, well-trained, and well-equipped, having entered the field. The GAZETTE proposes to stimulate, to assist, to record this activity, and no honest worker need fear that his work will be lost. And so this journal, strengthened by the struggles and successes of ten years, faces its second decade with the marks of undoubted success, and as it deserves, so will it expect the hearty support of every American botanist.

A LITTLE REFLECTION will show that the recent sale in New York city of orchids belonging to the Morgan estate, at which single plants brought from one to nine hundred dollars each, has some relation to the progress of botanical science. In this age any science is stimulated into increased activity by its objects becoming of commercial value. In the domain of electrical and me-

chanical sciences the importance of their applications has had a reciprocal influence upon the further development of them as pure sciences; plenty of illustrations to the same end might be taken from chemistry, mineralogy, zoology and other departments of learning. A case, analogous in some respects to that under consideration, is the wholesome growth of veterinary science in this country during the last few years, a progress to be traced in some degree to the great increase of thorough-bred and valuable stock whose owners demand the services of skillful and learned practitioners. The increased cultivation of rare and costly plants must in a similar way lead to a demand for additional knowledge in regard to various physiological, pathological and even structural matters which have a bearing upon their growth and well-being. The important question of timber in this country has led to the admirable botanical work of Professor Sargent in connection with the tenth census; in Germany, where the necessity of forestry knowledge has been still more keenly felt, much attention has been devoted to the diseases of trees, involving a careful investigation of the life histories of a number of species of fungi. Thus in many ways which the reader will have no difficulty in calling to mind does the market value of a class of objects have an indirect influence upon the recondite investigations which underlie the applications of science. One element in making this influence real and effective, however, is a readiness on the part of those holding commercial interests to accept scientific facts and to encourage their discovery. In agriculture, horticulture, floriculture, etc., it is unfortunately true that there is great backwardness in seizing and applying scientific results and methods, which hinders the advancement of those professions and at the same time fails to afford a needed stimulus to new investigations regarding plants and kindred subjects. Still there is hope of better things for the future; the fashion for orchids, roses, chrysanthemums, or other flowers, may not now mean much to the botanist, and yet in so far as any influence is really exerted upon botanical science it is beneficial.

IT SO HAPPENS that one of the editors has been using for reference both the dispensatories alluded to by "*R.*" in an "open letter." The opinion expressed by him is amply borne out by our experience. The descriptive terms of botany are carelessly used and distinctions which are important are entirely overlooked. Of course it is to be remembered that the dispensatories are not written for botanists, but for pharmacists and physicians, and this fact necessitates the use of somewhat less technical language. It is, however, a point to be insisted upon, that the absence of technicality ought not to mean inaccuracy. One of the volumes referred to is especially negligent in the matter of quoting authorities for the scientific names of plants. This frequently renders the identification of the plant named quite impossible. So many changes are constantly being made in the nomenclature that it is not to be expected that such works as these should keep up with them, though an attempt should be made to use the best established names. But in the midst of such changes and for the reason that the names are changeable, the least that can be done is to quote the authority for whatever name is used. When the next revision of these two very useful books is made, by all means let the editors use every en-

deavor to have the botanical portions as complete, exact and reliable as possible. At present they are neither exact nor reliable, though the latest editions are markedly better than former ones.

THE CUTTING UP of published exsiccatæ and distribution of the specimens in the general herbarium is advocated by Professor Bessey in the *American Naturalist* for December, and the method has much to commend it. This brings all the specimens of a group together and makes their examination simple and easy. The saving of time and patience may be well illustrated by an attempt to find a particular specimen in the unindexed and voluminous collections of von Thümen for example, which, unless much time is taken, may lead to no other result than doubt whether it occurs there or not. Uniform treatment of this kind has been generally adopted in the large phanerogamic herbaria of the country, and it seems to us could well be extended to the cryptogamic collections—in fact that there should be, when possible, but a single series in each herbarium, ranging from the protophyte to the highest angiosperm.

THE DAY IS not far distant, we believe, when phanerogamic botanists will do as zoologists, bryologists and mycologists are now doing in quoting authorities for plant names, *i. e.*, cite not only the name of him who combines the generic and specific names, but also the one who first distinguished the plant and assigned to it a specific name. The burden of synonymy is growing greater day by day.

THE GENERAL INDEX to the first ten volumes has been somewhat delayed in its preparation, but will soon be ready.

OPEN LETTERS.

Seeds wanted.

Professor Schübeler, of Christiania, Norway, whose works upon the history of cultivated plants and the changes that have occurred in the distribution of indigenous vegetation are so well known, greatly desires fresh seeds of our Indian rice, Hydropyrum esculentum, or Zizania aquatica. If any of our western botanists can supply them they will much oblige him, and also the subscriber,

ASA GRAY.

The Dispensatories.

I have had occasion to consult extensively the latest editions of the National and U. S. Dispensatories, and am much surprised at the looseness there found in the use of botanical terms and the frequent inaccuracy of the botanical information (?) there given. Surely, in works of such prominence and importance the very best botanical talent ought to be employed to contribute this portion, as has apparently been done in the chemical, pharmaceutical, and therapeutic parts. Perhaps a word from the GAZETTE would be of influence upon the next editions of these books.

R.

A Phallus.

If the reply be within the scope of the GAZETTE, I should be very glad to know if there be any means of extirpating from the soil the spores of a most

offensive Phallus. I do not know the species, but for a day or two before they appear above the ground the odor of carrion prevails, and as soon as visible, they are covered with large flies. They grow on a shady (but not damp) bank, in a poor loamy soil, and follow one another in most annoying succession. If any application to the ground can destroy them I should be greatly obliged for information. MARTHA BOCKÉE FLINT.

The Agricultural Department.

I was very much interested at Ann Arbor, last August, in two things connected with this department, viz: the action of the botanists with reference to making the national herbarium what it ought to be, and the hearty encouragement given to the new work under the charge of Prof. Scribner. I take this means of asking, either the editors of the GAZETTE, or the officers of the Agricultural Department, what has been the result of the action in these two cases? I know of many botanists ready to assist in both these directions if they can obtain the necessary information. S. N. T.

CURRENT LITERATURE.

Manipulation of the Microscope. By Edward Bausch. Bausch & Lomb Optical Co. Rochester, 1885. 12°. 96 pp. Illust.

The author has attempted, in this little work, to describe the parts of a microscope and their uses in such a clear and concise manner that the beginner, confronted for the first time with a new microscope, may have no difficulty in becoming acquainted with his instrument. We have no hesitancy in saying the object has been admirably accomplished; the language is lucid and simple, the treatment is brief, and yet all essential points have been covered, and the typography, form and cheapness of the work (50 cts.) are commendable.

As the author is a manufacturing microscopist, it is natural to anticipate a strong personal bias, and the reader will therefore be pleased to note that the firm's name occurs but twice in the work, and that it is as free from any advertising dodge as could well be. On the other hand, there is a decided advantage in the author being a well known manufacturer, as one is never at a loss for a concrete conception of the kind of instrument to which the remarks are specially applicable. The chapters of the work are devoted to the simple microscope, compound microscope, objectives and eye-pieces, requisites for work, how to work, advanced manipulation, sub-stage illumination, care of a microscope and considerations in testing objectives.

We commend the work to all who use a microscope, especially those who do not feel themselves full masters of the instrument, and it would also be excellent to put into the hands of the laboratory student at the beginning of his course.

Thirty-eighth Annual Report of the N. Y. State Museum of Natural History: Report of the Botanist. By Charles H. Peck. Albany, 1885. 8 vo. pp. 77–138. 3 plates.

This report is for 1884. It is gratifying to note that hereafter the reports of the Museum staff are to be printed under their immediate supervision, and as soon as ready. The work of the botanist which has been partially interrupted for two years through political interference, has been fully resumed, and the result is seen in the description of sixty-six new species in the present report, including a curious fungus on flies, assigned to a new genus, Appendicularia. A monograph of the New York species of Lactarius and Pluteus is also given, containing forty and nine species respectively. Mr. Peck says very truly that "a descriptive manual of our hymenomycetous fungi is greatly

needed," and we think he is just the person to write it. But if this is too great an undertaking at present, why not bring out a monograph of the New York species with colored plates, to be printed in the Museum series of quarto volumes; it would be of great scientific value, and of lasting credit to its author.

For the information of those who may not be aware of the fact we will state that the 32d report of the botanist, which was never distributed, may be found in Assembly Document 89 for 1879, vol. 6.

A Synopsis of the Bacteria and Yeast Fungi and allied species. By W. B. Grove, B. A. Chatto and Windus. London, 1884. 12°. 112 pp. 87 illustrations.

The account of these two classes of plants given by Winter in the last edition of Rabenhorst's *Kryptogamen Flora von Deutschland*, etc., has furnished the basis for several English works, and none more serviceable than the one in hand. Somewhat over half the book is practically a translation from that work, with notes by the translator, and some additional species, principally from Van Tieghem, Burrill, Kock and Hausen. Additional cuts are also introduced from various sources, of which the most interesting are those from Dallinger showing flagella. A chapter is given to forms which are inadequately known, or whose true bacterial nature is undecided, with such as could not be placed in the previous classification. These embrace over forty names from Zopf, Lankester, Lister, Thin, Engelmann, Warming, Van Tieghem, Klein, Ehrenberg and many others.

This, in the present unsatisfactory state of knowledge regarding these minute organisms, provides a very useful manual, giving good descriptions and illustrations, and indicating to some extent the synonymy and literature. The cuts are numerous and clear, but in many instances have lost in the reproduction much of the nicety of outline that gives individuality to the organism.

An interesting feature of the work is the chapter on classification in which the progress of classification is traced and the systems given that have been proposed at various times. The views that are more or less opposed to the classification of bacteria by Cohn are stated briefly but clearly and impartially. They are by Lister, Lankester, Cienkowski, Nägeli, Haberkorn, Neelsen and others, but especially by Zopf. The views of the latter on pleomorphism and its dangers are discussed, closing with a statement of the true nature of species among the schizophytes. In regard to the rank of the yeast plants considerable space is given to the hypothesis of Brefeld, who considers them to be a conidial stage of other fungi, probably of the smuts.

Appendices give information regarding the unit of micro-measurement, staining of Bacillus tuberculosis, and diseases produced by schizophytes. A full index completes the work.

The excellent appearance of the work and no less excellent contents should bring it into the hands of many workers.

NOTES AND NEWS.

DR. FRANZ, Baron Ungern-Sternberg, known as monographer of the Salicorniæ, died in Turin, Italy, August 12, 1885.

AN APPARATUS to demonstrate before classes or large audiences the manner in which the cambium gives rise to wood and bast, has been devised by Dr. F. Noll, of Heidelberg, and is highly spoken of by Professor Sachs.

DR. WINTER, of Leipsig, and C. H. Demetrio, of St. Louis, publish, in *Hedwigia*, a list of 350 species of various kinds of fungi collected in Missouri. Twenty-five new species are described, including six of Septoria and eight of Cercospora.

SIR JOSEPH D. HOOKER, after twenty years' service, resigned the Directorship of the

Kew Gardens on November 30. Being relieved of administrative duties he will have more time for the more important systematic work which he has on hands.

THE JOURNAL OF MYCOLOGY closes its first year with an expression of satisfaction at its reception and success, and promise of more varied contents, articles for beginners, and biological sketches of eminent mycologists for the coming year.

VERY CONSIDERABLE ATTENTION is devoted to hybrid forms of common wild plants in Sweden, judging from the frequent descriptions of named sorts in the *Botaniska Notiser*. They are species, some well known in this country as weeds, of such genera as Epilobium, Rosa, Primula, Rumex, etc.

COOKE'S PROVISIONAL LIST of the British Sphæropsideæ, publishing in *Grevillea*, reaches in the December issue to No. 478, having just entered the genus Septoria. The *Synopsis Pyrenomycetum*, begun in June, 1884, now reaches No. 2134. Only a few of these numbers are accompanied by descriptions.

THE DRUGS AND MEDICINES of North America, published in Cincinnati, is a far more important serial to non-medical botanists than its name would indicate. Its matter is original and fresh, and to a considerable degree strictly botanical; it includes synonymy, literature, description, distribution presented by maps, and minute anatomy, after which comes the medical portion. Even the latter need not be left entirely to the physician. It is printed on excellent paper and the illustrations are copious and admirably executed.

A PRIZE of 500 francs ($100) is offered for the best unpublished monograph on a class or family of plants, the award to be made in October, 1889. It may be written in English, and is to be sent to the *Société de Physique et d'Histoire Naturelle*, Geneva, Switzerland. The prize was founded by A. P. De Candolle. It would be a matter of just pride if some really valuable memoirs were presented by American botanists for this, and also for the Walker prize in plant embryology, which is announced in our advertising columns.

F. EMICH has made extended researches upon the self-purification of natural waters, (detailed in *Biedermann's Centralblatt für Agrikultur Chemie*) and finds that direct oxidation from the air does not occur and that ozone and peroxide of hydrogen play but a feeble part, if any. When exposed to air or agitated with it, purification does not take place if the water has been sterilized by boiling or germs are in any way excluded. The entire question of purification of rivers and other open channels is obviously removed from the sphere of chemistry and becomes purely biological.

THE AUCTION sale of the Morgan collection of orchids in New York City some months since developed the fact that considerable attention is given to orchid cultivation in this country. The sale included over 1,450 plants, very few of them in flower at the time, for which Mrs. Morgan is said to have paid $200,000. A specimen of Vanda Sanderiana, bought by Veitch & Sons of London, brought $900, the highest price paid for a single plant; it is said to have cost $2,000. It is a rare and lovely species from Mindanao, one of the southern Phillipine islands, and first flowered in cultivation about two years ago. Another equally good plant of this species is owned by Mr. F. L. Ames of North Easton, Mass. Nine plants of Cypripedium brought from $100 to $750 each, all but one going to England.

THE ANNUAL FUNGUS FORAYS of England are an interesting feature of mycologic study in that country. They are excursions arranged by the societies to some collecting ground, where the party tramps through the fields, collecting fungi especially, and in the evening dines with a liberal *cuisine de champignon*, if the day has been successful. After the day's collecting the finds are displayed, named and commented upon. In the evening are papers and discussions. The meetings last from one to four days, and usually take place in October. The year 1885 proved a poor season for the larger fungi, and the gatherings have therefore lacked somewhat in interest. The Essex Field Club gave two days, the Tunbridge Wells Nat. Hist. Society, the Hertfordshire Nat. Hist. Society, the Hackney Nat. Hist. Society and the Leicester Nat. Hist. Society one day each, and the Woolhope Club four days.

STRASBURGER, at a meeting of the German Botanical Society on the 17th of September last, presented the results of some recent experiments (not yet completed) to ascertain the limits within which plants specifically distinct will permit effective grafting or budding, and the reciprocal influence of the stock and graft. He grafted a large number of various

species of Solanaceæ on Solanum tuberosum and *vice versa*. Almost all of the grafts "took" and union was complete. The best results were obtained with Datura Stramonium on Solanum, the specimens of which formed good-sized tubers containing a small quantity of *atropine!* He also succeeded in grafting the Scrophularineous Schizanthus Grahami on Solanum, a most interesting result, and probably the first authentic instance of the union of two plants of different orders. He was led to attempt this because the potato-rot fungus develops on Schizanthus. The further results of these experiments and the promised histological investigation will be looked for with interest. The present paper is published in *Berichte d. deut. bot. Gesell. iii, XXXIV.* (Nov. 19, 1885).

ANOTHER PAPER is to be added to the already voluminous literature of the apparently interminable discussion of the morphology of the female flower of the Coniferæ. Kramer, in a recent paper[1], espouses the idea that in the Cupressineæ the scales of the cone are carpels which bear the ovules in their axils, and that the peculiar contour of these scales is not due to the coalescence of two organs, the bract and carpellary scale (*Deckschuppe* and *Fruchtschuppe*) as claimed by some, but is produced by mere swellings of no morphological significance. In the Abietineæ he considers the *Deckschuppe* of Strasburger and others as the carpel and their *Fruchtschuppe* as the placenta formed in its axil. This placenta, instead of remaining small, increases greatly in size, the more rapid growth of the under side reverses the position of the ovules, and it finally encloses them completely. According to this view of course the cone of these tribes would be considered a single flower and not as an inflorescence. Much has been said on both sides—and still it is doubtful where the truth is. An account of the development of the cones of fourteen species of Cupressineæ and Abietineæ forms the bulk of the paper.

WHAT IS CALLED a case of symbiosis between a fungus and the roots of certain trees has been described by Frank in the *Berichte der deutschen botanischen Gesellschaft.*[2] The fungus completely invests the absorbing rootlets of the trees, so that the nutritive solutions pass through the mycelium before entering them. To this symbiotic condition he applies the term Mycorhiza, and in a more recent contribution[3] to the same subject he makes *en resumé* these statements: 1. Mycorhiza is a symbiotic relation of which perhaps all trees are capable under certain conditions. This has been observed in almost all Cupuliferæ, in Coniferæ and Salicaceæ, in the Betulaceæ nearly allied to Cupuliferæ, in the linden and Prunus spinosa. 2. Mycorhiza is formed only in a soil which contains humus or undecomposed vegetable matter. The development of mycorhiza diminishes with the poverty and increases with the richness of the soil in these constituents. It has been observed to vary even on the same root as it passes through different layers of soil containing different amounts of organic matter. 3. The fungus of mycorhiza supplies to the tree, in addition to the necessary water and organic and mineral nutritive matters, substances derived directly from the humus and decaying vegetable matter. The tree is capable of this immediate reconversion of organic vegetable *débris* for nourishment only through the intervention of the mycorhiza fungus. 4. The old theory of the direct nutrition of green plants by humus will be revived though with a modified meaning. 5. The importance of humus and fallen leaves for the nutrition of forests acquires a new theoretical support. 6. While the symbiotic nutrition is chiefly of importance where, as in trees, it assists in the production of vast quantities of vegetable matter and where the immediate reconversion of vegetable *débris* is highly helpful, yet mycorhiza can render service when nutrition from humus becomes a necessity on account of the absence of chlorophyll, as in Monotropa Hypopitys.

It is to be noticed, however, that in neither of his papers on the subject has Frank demonstrated that this is a genuine symbiotic relation. The mycelium is sterile and no cultures or infection experiments have been carried on. The observed facts are interesting and probably important, but it will be well to hold aloof from his hypothesis of symbiosis until more exact knowledge is obtained.

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[1]Beiträge zur Kenntniss der Entwickelungsgeschichte und des anatomischen Baues der Fruchtblätter der Cupressineen und der Placenten der Abietineen.—Flora, Nos. 29, 30, 31, 1885.

[2]Band iii, heft 4, p. 128.

[3]Berichte d. deut. bot. Gesell., iii, XXVII: Nov. 19, 1885. In this paper he shows the existence of the same symbiosis between the fungus and roots of Monotropa Hypopitys.

SCRIBNER ON ARCTIC GRASSES.